

# AST Simulation for New Generation Aircraft



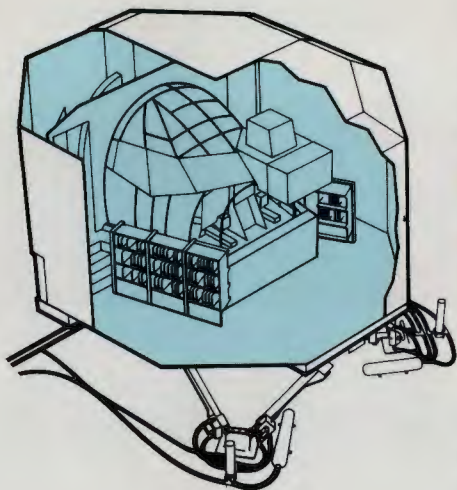












**L**INK\* flight simulators continue to set standards for flight training. ADVANCED SIMULATION TECHNOLOGY provides the framework for unexcelled simulator performance and economy of ownership. The AST\* simulation approach has proven ideal for airline flight training needs. Its advantages include:

**HIGH PERFORMANCE**  
**LOW LIFE CYCLE COSTS**  
**EASY MAINTENANCE**

**High performance:**

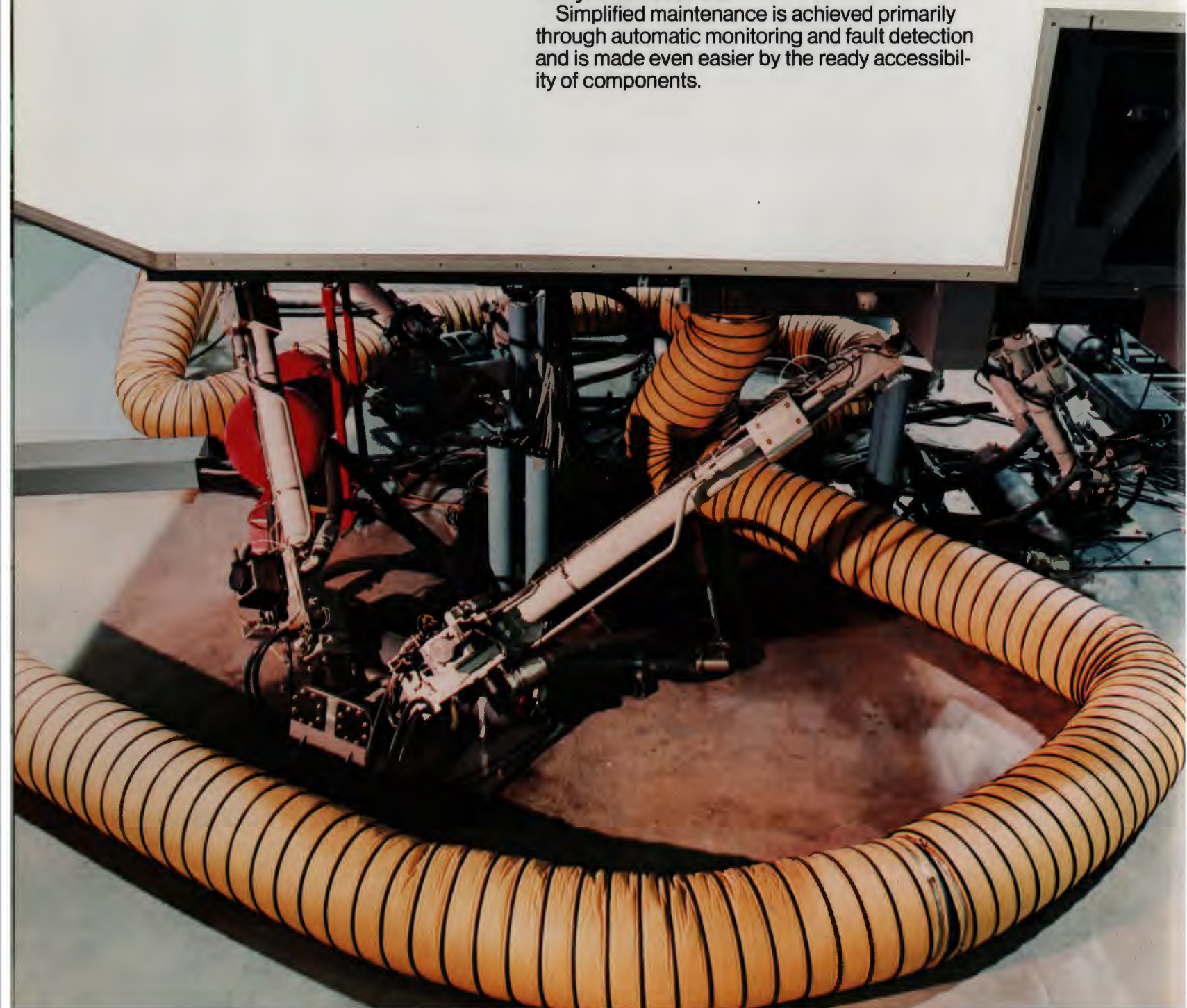
Highest possible fidelity achieves total simulation as required by the Federal Aviation Agency (FAA) Phase I, II, and III regulations.

**Low life cycle costs:**

Fewest possible components reduce repair time and spares requirements dramatically.

**Easy maintenance:**

Simplified maintenance is achieved primarily through automatic monitoring and fault detection and is made even easier by the ready accessibility of components.







## PACKAGING



AST\* ADVANCED PACKAGING was developed after extensive human engineering analyses of various transport aircraft compartments. The result: an entirely new approach which provides unique benefits.

Link has departed from the conventional practice of building the simulator exterior to resemble the simulated aircraft. Instead, a functional design offering significant operational and maintenance advantages has been implemented.

Nearly all AST\* simulator components are situated within an octagonal enclosure about the simulator cockpit. The enclosure is mounted on an advanced motion system. The space between the cockpit and enclosure houses electronics components.

Since the electronics is "on board," close to the hardware it services, cable lengths are shortened and electrical interference greatly reduced. Space requirements are cut 80%. The electronics is readily accessible for servicing.

### ADVANTAGES

Cleaner Appearance

Better Space Management

Reduced Electronics Interference

Easily Identifiable Electronics Areas—Easy Troubleshooting

Functional Design—Accessibility for Maintenance





## INTERCONNECTION SYSTEM

THE INTERCONNECTION SYSTEM encompasses all electronics and wiring between the digital computer and the simulator's flight compartment.

Conventional simulators require miles of cables, interface cabinets and wired backplanes. This results in a mass of technical documentation and involves assemblies that are difficult to troubleshoot.

Link has developed a new approach: the AST\* digital transmission bus concept. All system communications between the computer and flight compartment are now handled digitally, on cards. A single device, the LINK master controller, interfaces with the computer, which itself communicates with a number of subcontrollers on a common transmission bus. Each subcontroller transmits signal data to the system cards it controls.

This unique digital transmission "highway" eliminates approximately 400-500 cables and several equipment cabinets and is so compact that it uses only 20% of the space previously required.

The "bottom line" is a digital bus concept that improves performance and reliability and also makes possible automatic test features which reduce equipment maintenance time and cost.

### ADVANTAGES

- Cleaner Appearance
- Easy Maintenance
- Fewer Spares Requirements
- Simplified Electronics—More Responsive to the Simulation Task

## AUTOMATIC TEST FEATURES

LINK AUTOMATIC CONTINUOUS CLOSED-LOOP TESTING SYSTEM (ACCTS) continuously monitors the simulator, providing fault isolation while training is in progress. A realtime monitor automatically tests each input and output conversion device several times per minute, tracing faults to a single circuit board—in many instances, isolating the failure to within three chips.

These continuous and concentrated test capabilities quickly localize intermittent problems. Any detected failure can be immediately displayed on the computer terminals; the readout is so accurate that it can be used for calibration and adjustments.

### ADVANTAGES

- Quick, Accurate Fault/Problem Diagnosis
- Faster Repair
- DECREASED MAINTENANCE TIME—
- INCREASED TRAINING TIME





# CONTROL LOADING SYSTEM

The AST\* HYDRAULIC CONTROL LOADING SYSTEM simulates the characteristics of the aircraft's primary flight controls—wheels, columns and rudder pedals. Changes in the amount of movement and force on the controls are a function of aircraft acceleration, velocity, configuration, center of gravity, and the type of control system peculiar to the aircraft. The primary control transmits the pilot input to the airframe, and since the position and "feel" provide control feedbacks, their proper presentation to the pilot is one of the most valuable training features of a flight simulator.

The AST control loading system differs from previous LINK\* designs. Its mechanical, hydraulic and electronics subsystems have been improved and augmented by additional capabilities. The result is a highly responsive, wide-dynamic-range, smooth and stable system. Its flexibility allows common hardware to be used in all three channels, makes possible an exceptionally close match to the aircraft control characteristics and allows for modifications in the aircraft system.

## ADVANTAGES

- Ultra-Smooth System Operation
- Overall Better Control Feel to Pilot
- Reduced Spares Requirements





VISUAL SYSTEM





Link's latest development in visual simulation is the IMAGE II\* visual system, a compact flight simulator attachment which presents computer-generated color scenes representing the outside world. These scenes normally depict specific airports and their surroundings as viewed at dusk or night.

The IMAGE II\* system is designed to meet FAA Phase II requirements and can be upgraded to our IMAGE III\* configuration. This will be a full daylight system which will satisfy Phase III criteria for 100% simulation.

This new-generation visual system employs microprocessors instead of a large mainframe computer. Its distributed-processing technology offers many improvements and advantages over other systems, including enhanced image quality, more realistic display surface representation and occulting, increased random light capability and easier switching from one airport to another.

Night scenes include light points, horizon glow and runway markings and textures in the area of the simulated aircraft landing lights. In dusk conditions, ground surface and building textures are shown in addition to the lights and major features, both static and dynamic. Occulting of lights, surfaces and horizon glow by intervening surfaces is simulated at all times.

## ADVANTAGES

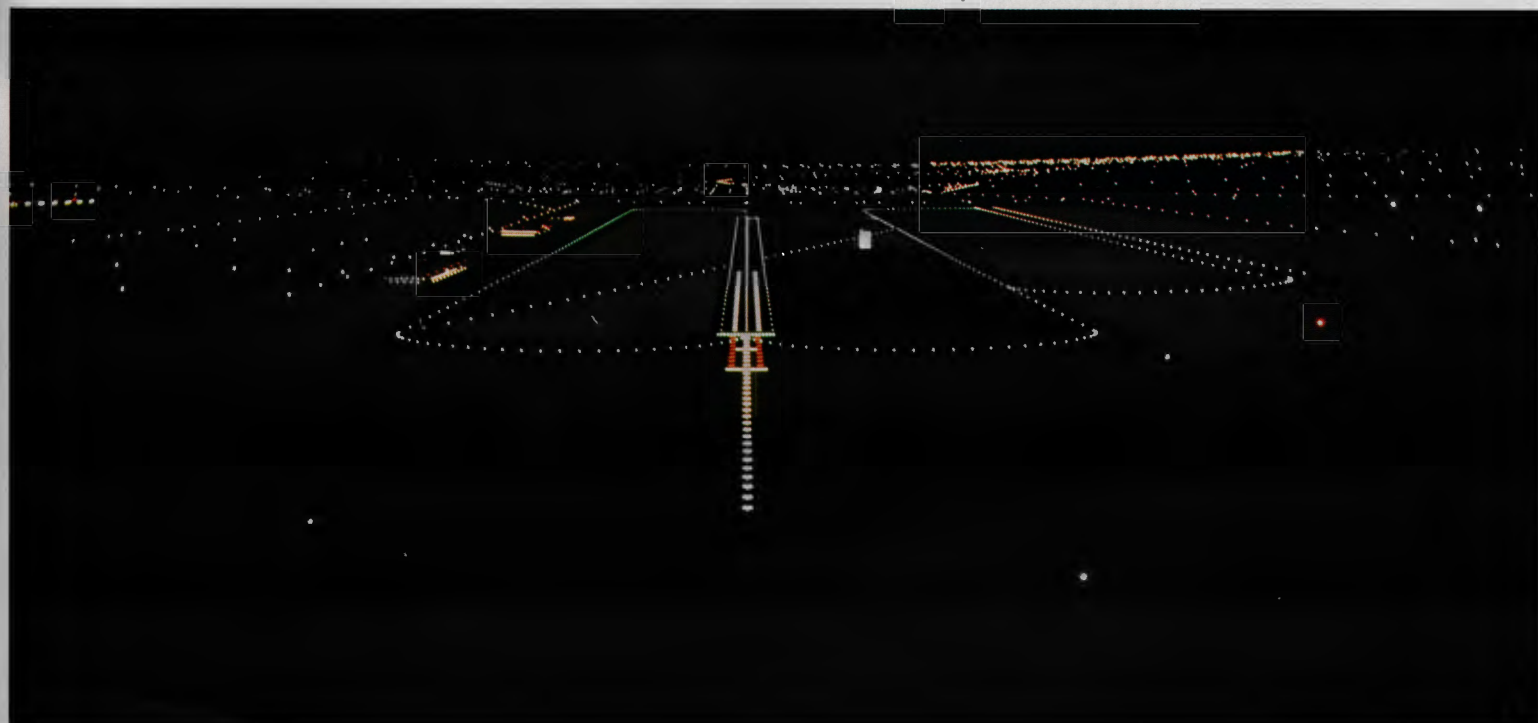
Superior Performance/Cost Ratio

Greater Reliability

Easier Maintenance

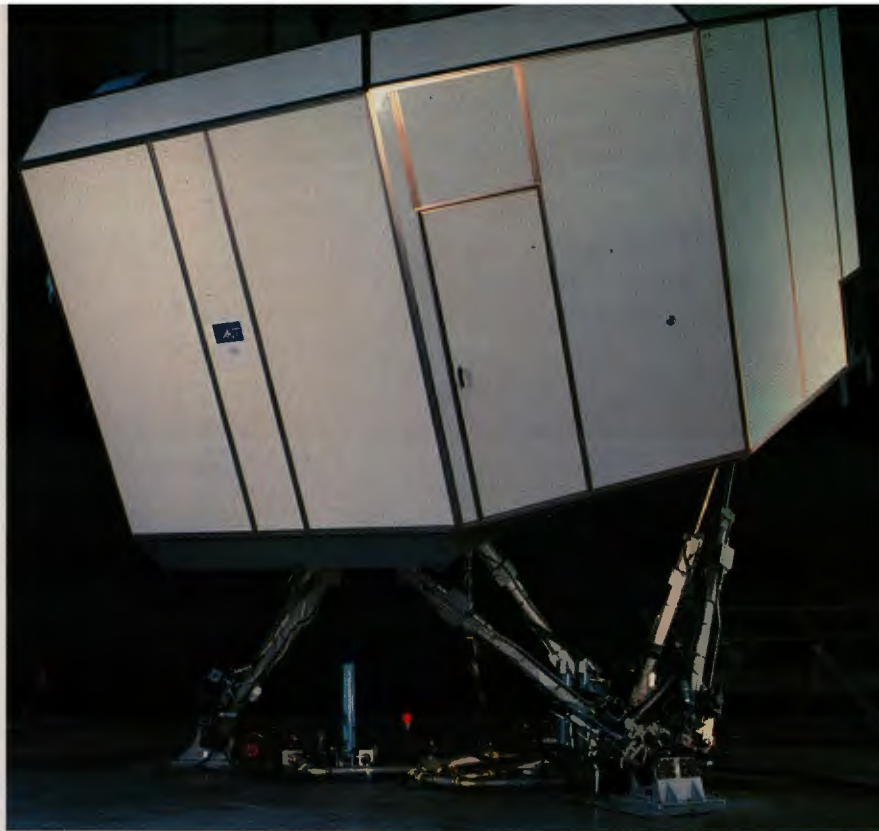
Lower Overall Life-Cycle Costs

(Link can also assume full responsibility for the integration of any other type of computer-generation visual system.)





# MOTION SYSTEM



The AST\* six-degree-of-freedom motion system employs advanced concepts to achieve a very high level of performance. It incorporates the best features of previous motion systems and includes significant improvements.

Extremely low-friction actuator legs with cushioning safety devices ensure smooth operation of the system. Hydrostatic bearings minimize weight and inertia.

The geometry is optimized to reduce the forces on actuators and joints.

The platform provides maximum usable area.

Upper and lower joints are of a common design.

Specially designed safety cushions permit the absorption of maximum kinetic energy.

Input power and cooling requirements are sized for economy of operation.

The motion system hardware, including the electronics, is streamlined, reducing dramatically the number of connections and parts. More than two-thirds of the plumbing previously required is eliminated.

The motion electronics, which communicates directly with the interconnection system's digital transmission bus, is contained in one small cabinet and uses only four PC board types.

## ADVANTAGES

Cleaner Appearance

Easy Equipment Access—Easier Maintenance

Greater Reliability

Economy of Operation







# INSTRUCTOR STATION

THE INSTRUCTOR STATION provides maximum simplicity of operation.

The compact instructor's panel affords superior instructor control with a minimum of effort.

Instrumentation on the instructor's panel is functionally grouped and color-coded.

A high-quality CRT system provides clear alphanumeric information.

The instructor station operates through the interconnection equipment, enhancing reliability and maintainability.

## ADVANTAGES

**Flexible CRT Display System—EASY, INEXPENSIVE UPDATE OF SYSTEM CONFIGURATION**

**Elimination of Expensive Hardware Changes—COST SAVINGS**

**Simplicity of Operation—REDUCED INSTRUCTOR FAMILIARIZATION TIME  
MORE EFFICIENT USE OF TRAINING TIME**





## SOUND SIMULATION

Significant sounds audible in the flight compartment during operation of the aircraft are reproduced in the simulator. Sounds simulated include power plant, aerodynamic noise, landing gear actuation, runway effects, auxiliary power units and air conditioning air flow.

Sounds generated by on-board devices such as horn, bells and chimes are produced with actual aircraft hardware. Those produced by aircraft equipment (e.g., engines) and physical phenomena like aerodynamic noise are digitally-generated by the AST\* aural cue system.

The system uses data based on analyses of tape recordings from the airframe manufacturer. Four high-fidelity loudspeakers reproduce major aircraft sounds such as engines, APU, ground power and ventilation. Two supplementary speaker systems provide aerodynamic noise. The large enclosure surrounding the flight compartment permits the primary speakers to be positioned further from crew positions than in conventional simulators, **enhancing directional realism.**

### ADVANTAGES

**Simplified Electronics—Easier Maintenance**

**Accurate Sound Reproduction—Optimal Realism**





## COMPUTER SYSTEM

AST simulators are designed to employ the best computation systems available. Link's present choice is the Systems Engineering Laboratories (SEL) 32/77, one of the most powerful computers of its kind. This high-performance real-time computer is built around a multiple, high-speed, synchronous, shared multiplexed bus system. With the full set of peripheral units—a high-capacity disc system, a versatile printer/plotter unit and multiple maintenance CRT terminals—the 32/77 is ideally suited to AST\* simulation tasks.

An extensive diagnostic package and advanced features such as memory error correction code (ECC) provide for easy maintenance which complements the computer's proven high reliability. But equally important is the reliability of the people behind the software—the Link engineers whose work is critical in advancing aircraft simulation.

Link's outstanding personnel, trained by a company with unsurpassed experience, continues to explore all developments in computer technology. Link engineers are responsible for incorporating these new techniques, including microprocessor technology, into AST\* flight simulation.

### ADVANTAGES

**Flexible AST\* Design—ADAPTABILITY TO BEST PROVEN COMPUTATION SYSTEM**

**Link's SEL 32/77 Knowledge/Experience—PROVEN SUPPORT CAPABILITY**

**Superior Engineering Personnel—EXPLORATION OF NEW COMPUTER TECHNOLOGIES**





## CUSTOMER SUPPORT



Link's unrivaled experience in designing and building simulators is backed by an unsurpassed field service organization. Customers thus are assured of around-the-clock around-the-world support.

### Field Service

Link's field support team assures customers maximum simulator utilization. Among services provided:

Upgrading of Simulators

Simulator Modification

Troubleshooting

Service Bulletins and Other Documentation

Consultation

### Spares Support

Link ensures spares support following initial purchase. Even if a part is out of production, Link can provide its equivalent.

### Training

The intent of the training Link offers is to enable the buyer to operate, maintain and troubleshoot any part of the purchased simulator. The quality of our training makes this goal achievable.

### ADVANTAGES

Responsive, Responsible Personnel

High-Performance Simulation

Satisfied Customers









**THE SINGER COMPANY**